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PATENT & TRADEMARK OFFICE

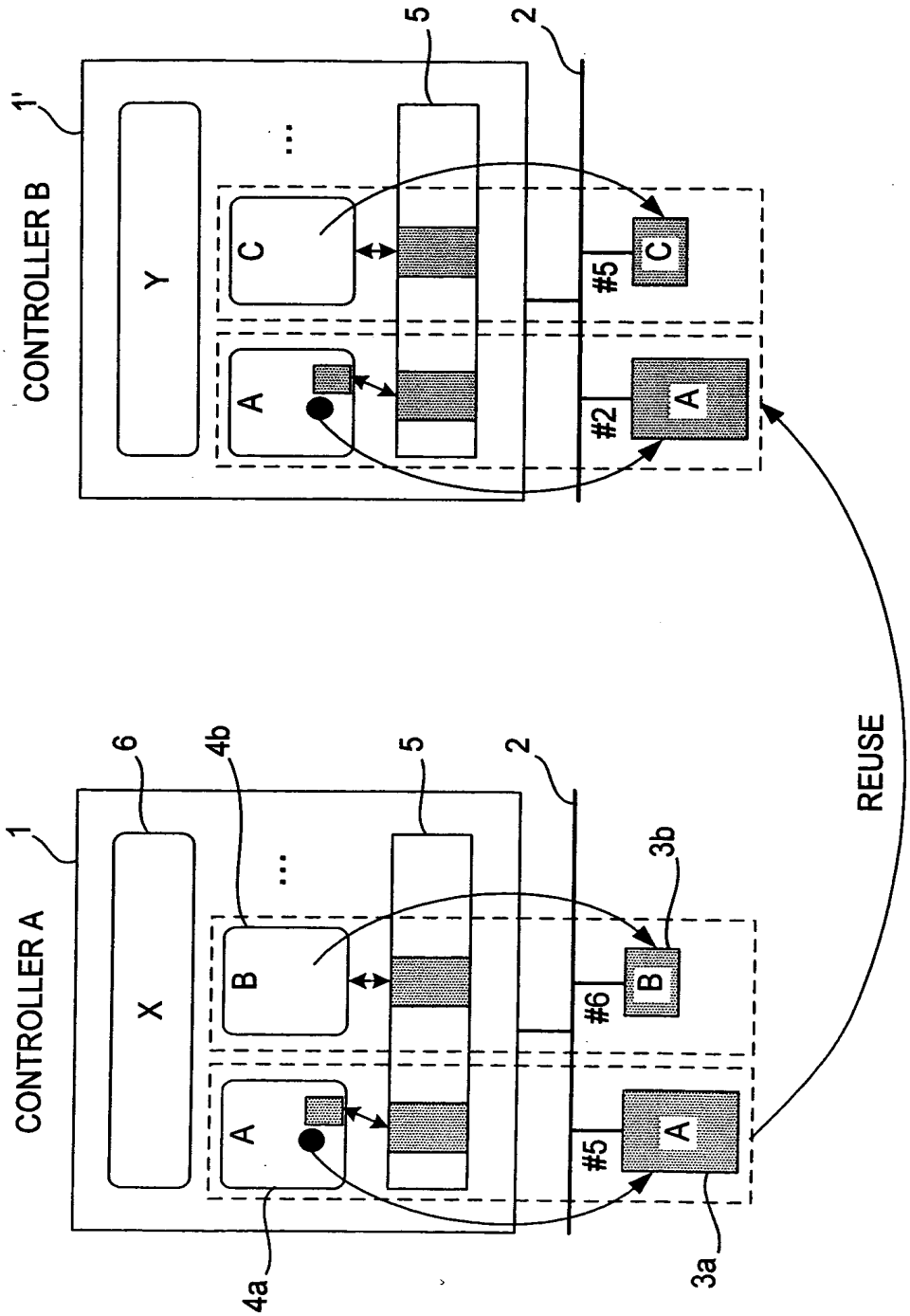

FIG. 1
(PRIOR ART)

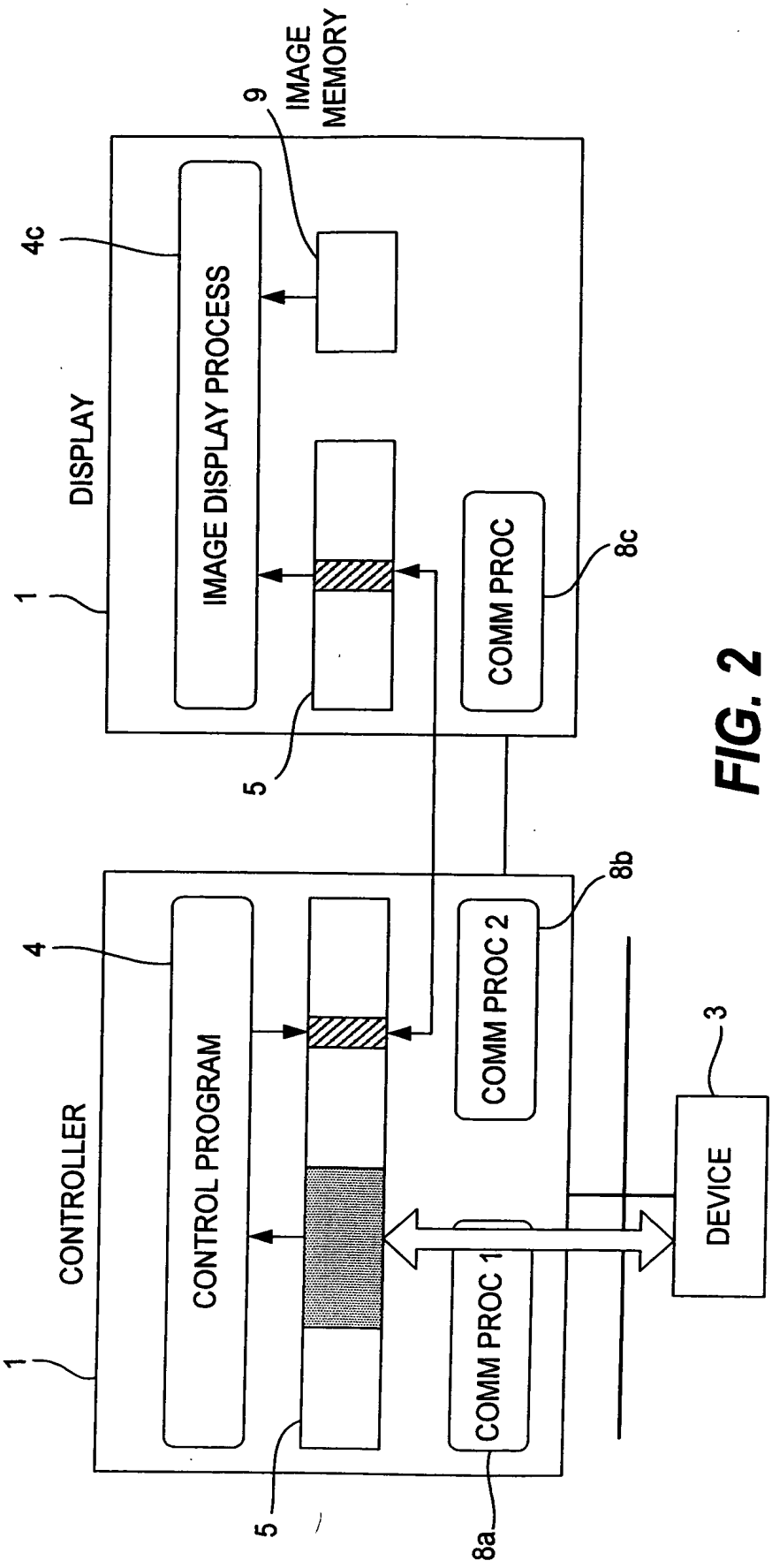

FIG. 2
(PRIOR ART)

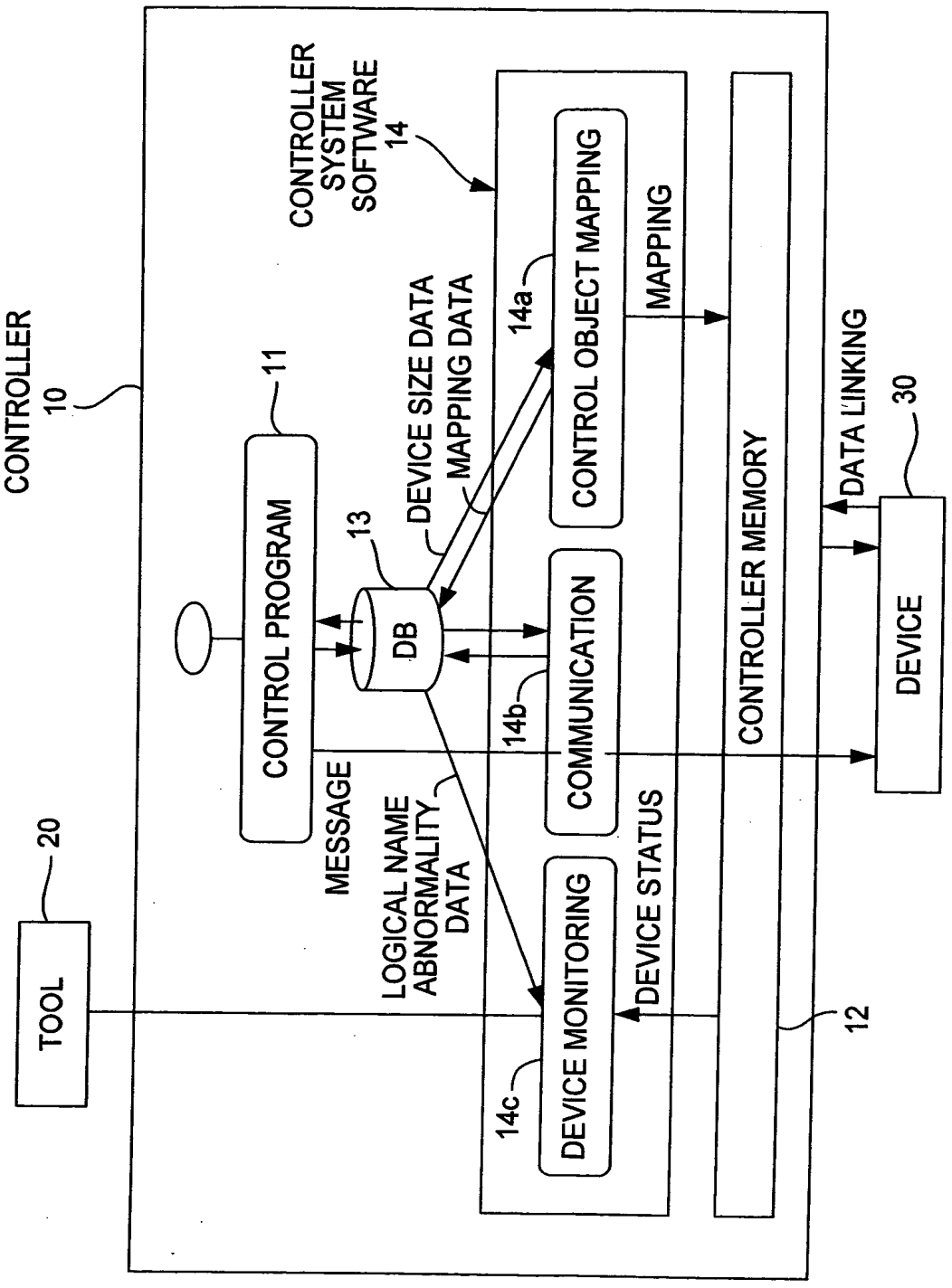
CONTROLLER
10
CONTROLLER SYSTEM SOFTWARE
14
11
CONTROL PROGRAM
13
DB
DEVICE SIZE DATA
MAPPING DATA
14a
CONTROL OBJECT MAPPING
MAPPING
14b
COMMUNICATION
MESSAGE
LOGICAL NAME ABNORMALITY DATA
DEVICE STATUS
14c
DEVICE MONITORING
CONTROLLER MEMORY
12
DATA LINKING
30
DEVICE
20
TOOL

FIG. 3

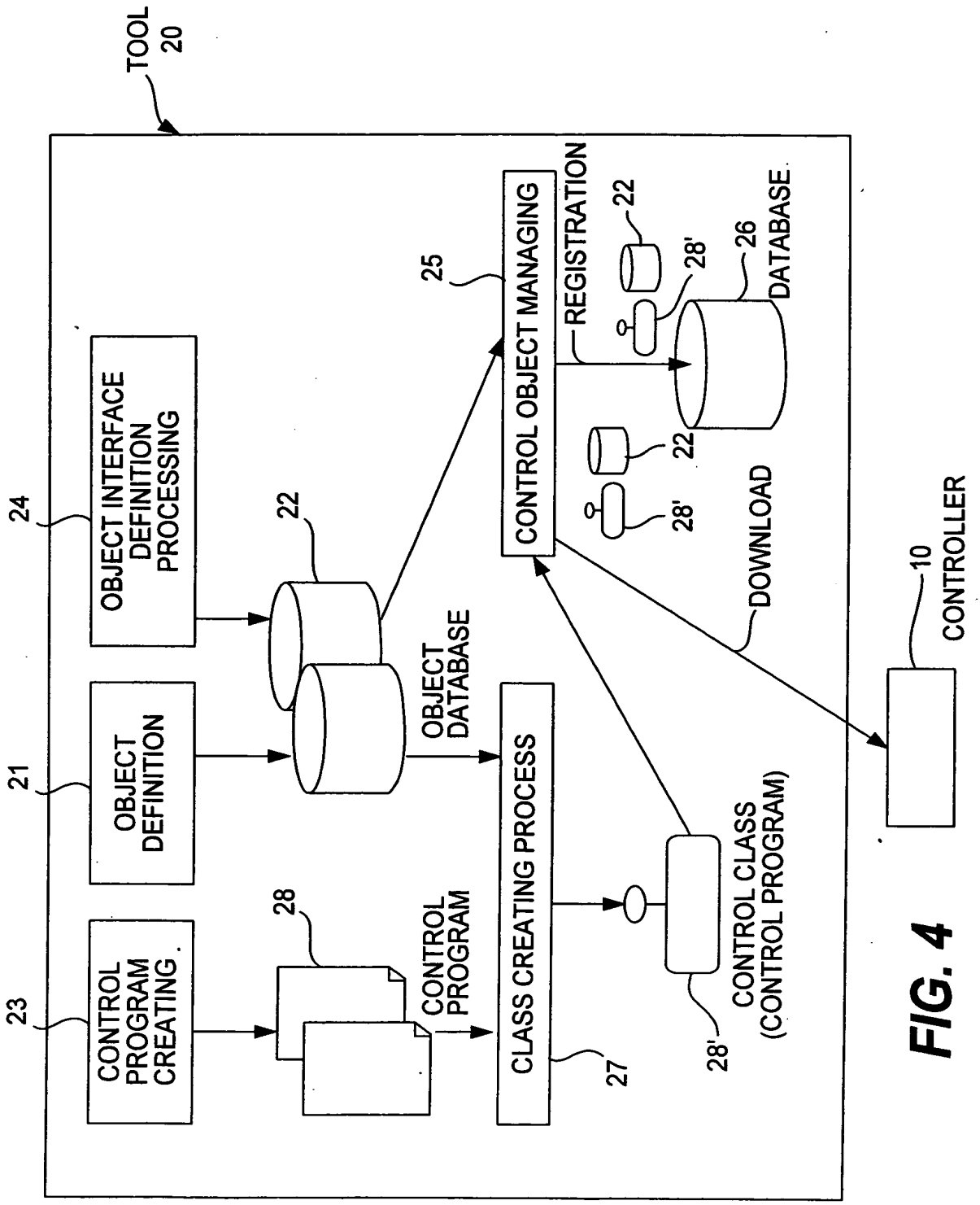
TOOL
20
OBJECT INTERFACE DEFINITION PROCESSING
24
OBJECT DEFINITION
21
CONTROL PROGRAM CREATING
23
22
OBJECT DATABASE
28
CONTROL PROGRAM
CLASS CREATING PROCESS
27
25
CONTROL OBJECT MANAGING
REGISTRATION
22
28'
26
DATABASE
22
28'
DOWNLOAD
28'
CONTROL CLASS (CONTROL PROGRAM)
10
CONTROLLER

FIG. 4

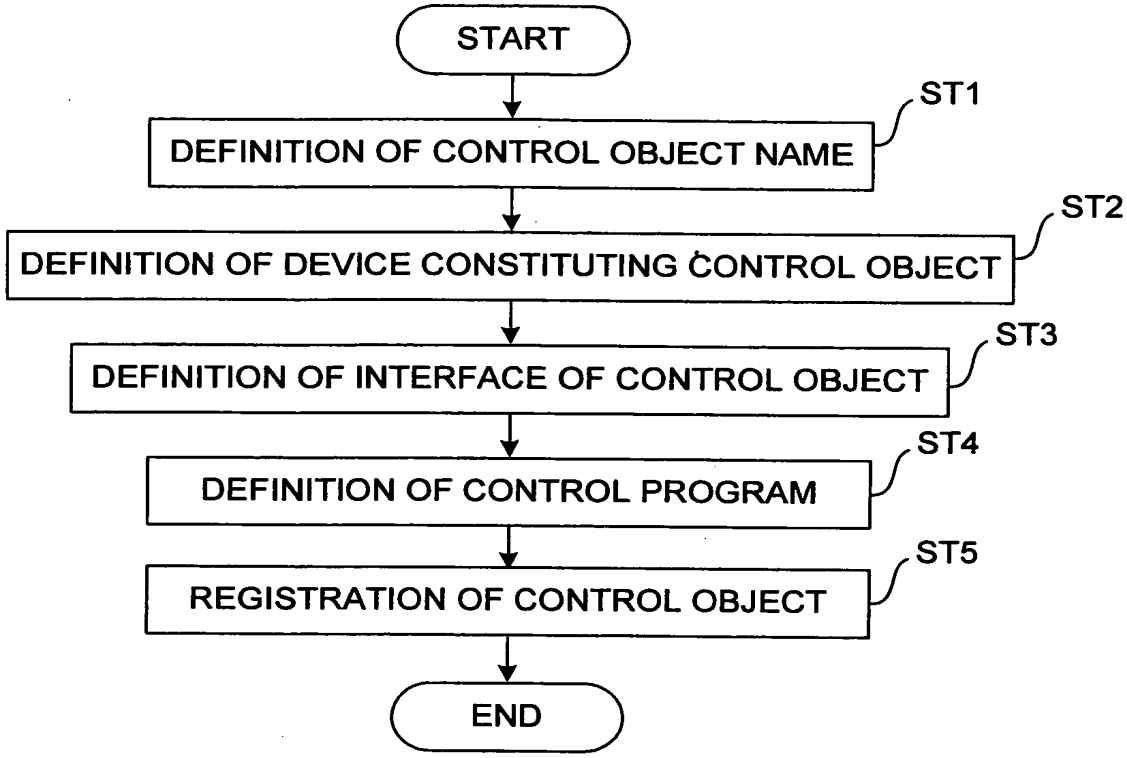
START
ST1
DEFINITION OF CONTROL OBJECT NAME
ST2
DEFINITION OF DEVICE CONSTITUTING CONTROL OBJECT
ST3
DEFINITION OF INTERFACE OF CONTROL OBJECT
ST4
DEFINITION OF CONTROL PROGRAM
ST5
REGISTRATION OF CONTROL OBJECT
END

FIG. 5A

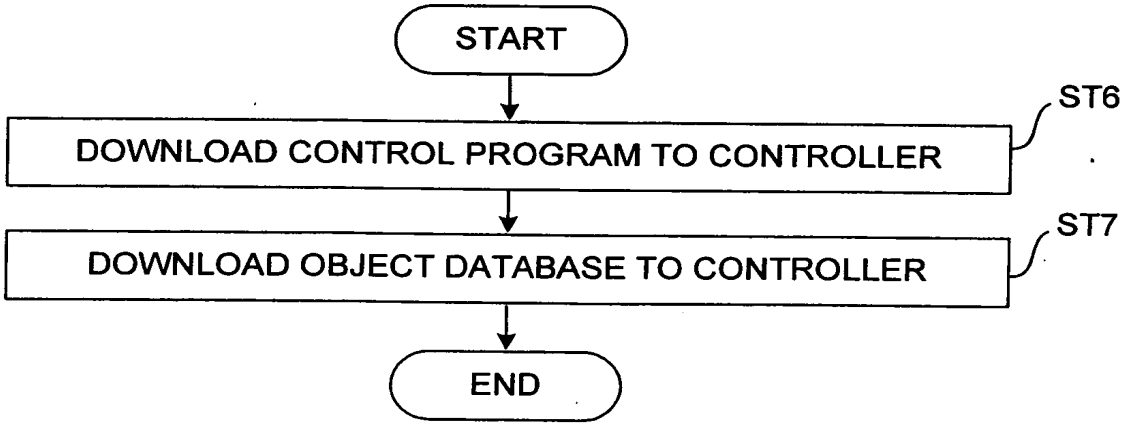
START
ST6
DOWNLOAD CONTROL PROGRAM TO CONTROLLER
ST7
DOWNLOAD OBJECT DATABASE TO CONTROLLER
END

FIG. 5B

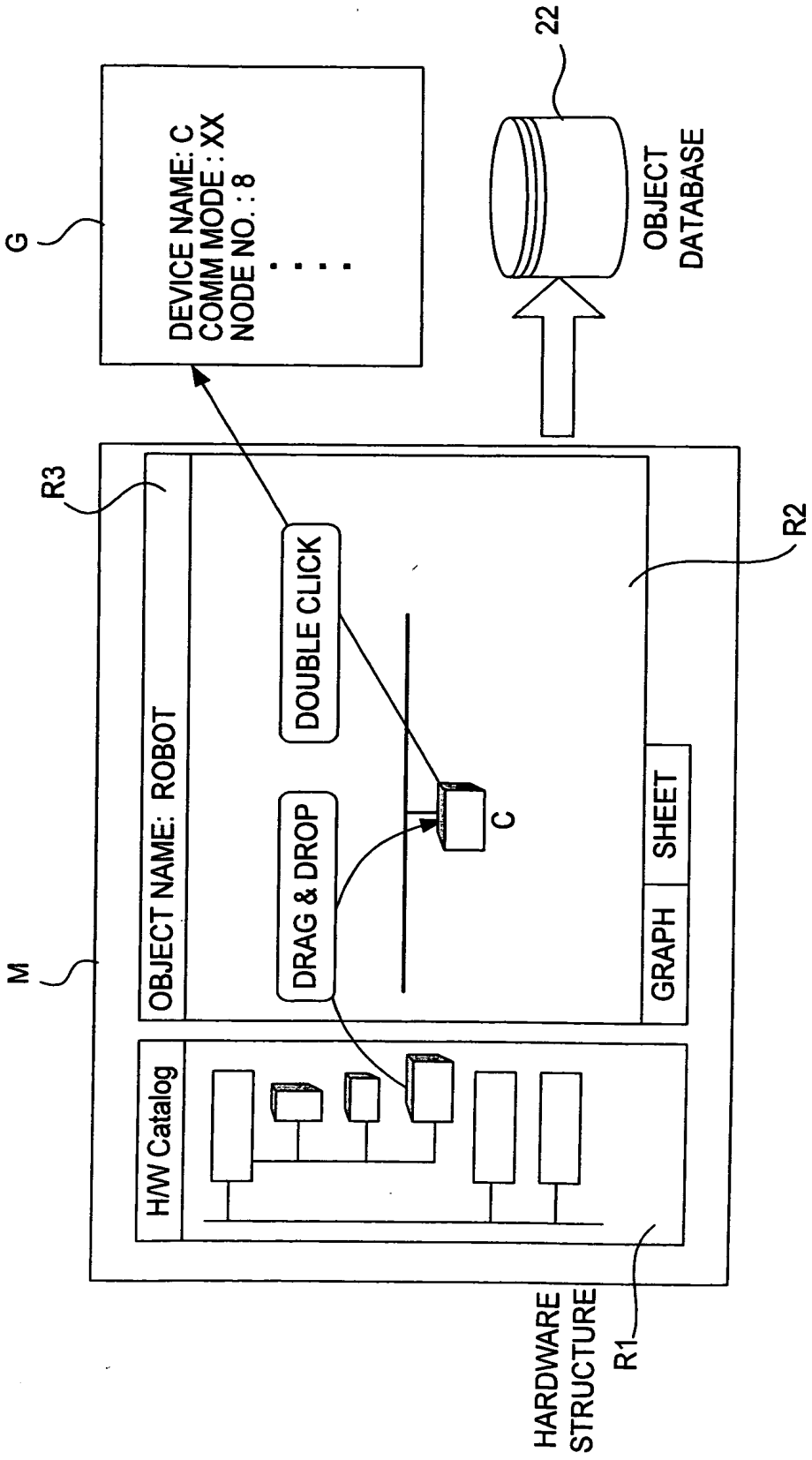
22
OBJECT DATABASE
G
DEVICE NAME: C
COMM MODE : XX
NODE NO. : 8
. . .
R3
R2
M
OBJECT NAME: ROBOT
DOUBLE CLICK
DRAG & DROP
C
GRAPH
SHEET
H/W Catalog
HARDWARE STRUCTURE
R1

FIG. 6

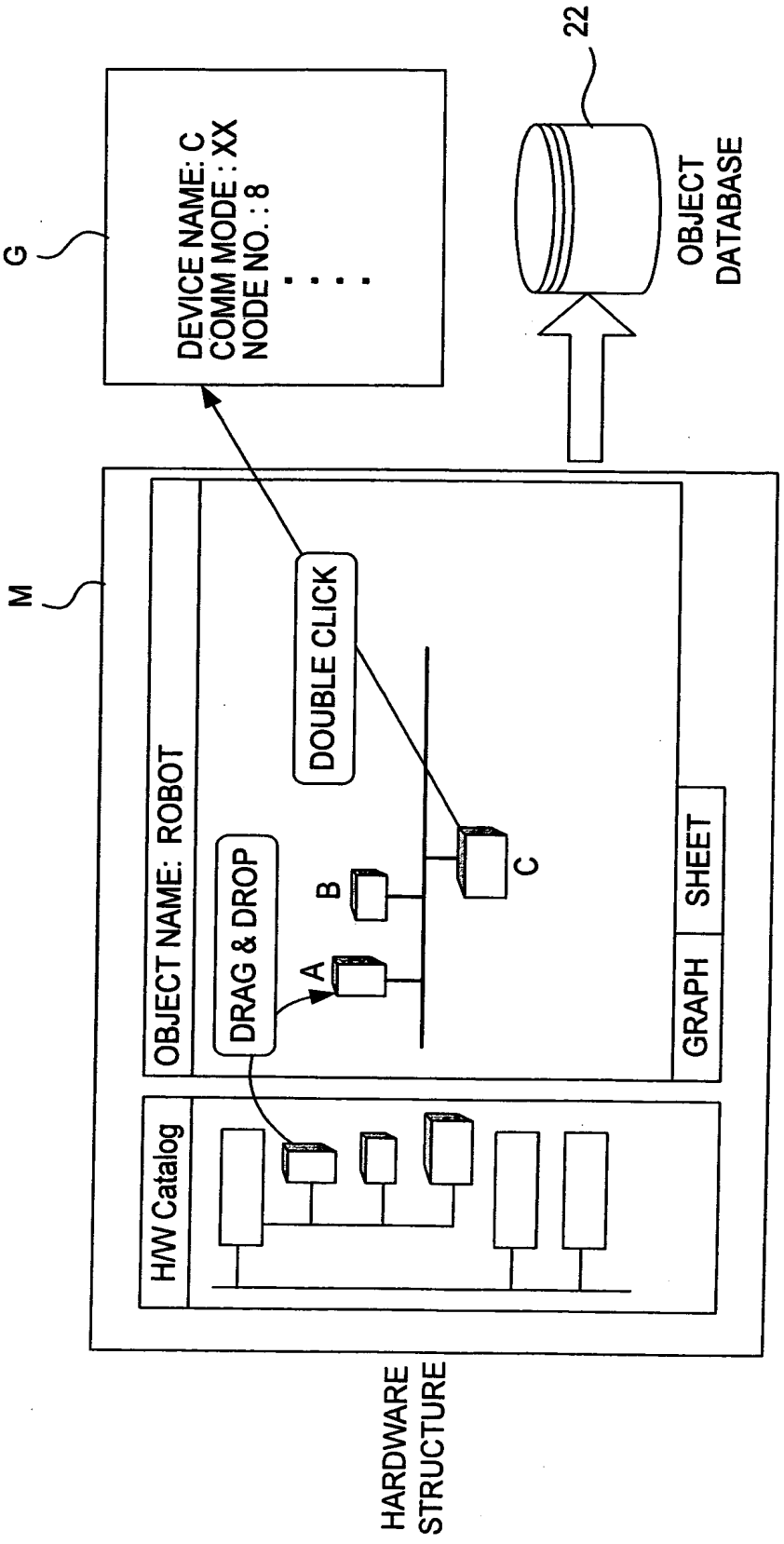
G
DEVICE NAME: C
COMM MODE : XX
NODE NO. : 8
. . .
22
OBJECT DATABASE
M
OBJECT NAME: ROBOT
DOUBLE CLICK
DRAG & DROP
A
B
C
H/W Catalog
GRAPH
SHEET
HARDWARE STRUCTURE

FIG. 7

```
[Profile]
ObjName= ROBOT

DeviceNum=1
   DevName0=C
   SerialNo0=
   NodeNo0=8  / / COMMUNICATION ADDRESS
   INSize0=2  / /byte
   INadr0=  / / MAPPED ADDRESS TO CONTROLLER MEMORY
   OUTSize0=2  / /byte
   OUTadr0=  / / MAPPED ADDRESS TO CONTROLLER MEMORY
   Communication0=0  / / COMMUNICATION MODE
```

FIG. 8

```
BYTE  Add_Val(BYTE X, BYTE Y)
{
   BYTE A, B; C
   Get_Attribute("IN_param1", A);
   Get_Attribute("IN_param2", B);
   C=A+B
   Set_Attribute("OUT_param1, C);
   Return C
}
```

FIG. 11

```
ObjName= ROBOT

DeviceNum=3
   DevName0=C
   SerialNo0=
   NodeNo0=8
   INSize0=2
   INadr0=
   OUTSize0=2
   OUTadr0=
   Communication0=0

   DevName1=A
   SerialNo1=
   NodeNo1=3
   INSize1=4
   INadr1=
   OUTSize1=4
   OUTadr1=
   Communication1=0

   DevName2=B
   SerialNo2=
   NodeNo2=1
   INSize2=1
   INadr2=
   OUTSize2=1
   OUTadr2=
   Communication2=0
```

FIG. 9

REPLACEMENT SHEET

```
[Profile]

ObjName= ROBOT

DeviceNum=1
   DevName0=C
   SerialNo0=
   NodeNo0=8  / / COMMUNICATION ADDRESS
   INSize0=2  / / byte
   INadr0=   / / MAPPED ADDRESS TO CONTROLLER MEMORY
   OUTSize0=2   / / byte
   OUTadr0=  / / MAPPED ADDRESS TO CONTROLLER MEMORY
   Communication0=0   / / COMMUNICATIONS MODE
[Attribute]
IN_Num=2
   ValName0=IN_Param1  / / VARIABLE NAME
   ValSize0=1  / / 1byte  / / VARIABLE SIZE
   Adr0=0/0  / / ADDRESS INSIDE CONTROL OBJECT (0 BIT OF 0 CH)
   ValName1=IN_Param2  / / VARIABLE NAME
   ValSize1=1 / / byte  / / VARIABLE SIZE
   Adr0=0/8  / / ADDRESS INSIDE CONTROL OBJECT (8 BIT OF 0 CH)

OUT_Num=2
   ValName0=OUT_Param1
   ValSize0=1  / / 1byte  / / VARIABLE SIZE
   Adr0=0/0  / / ADDRESS INSIDE CONTROL OBJECT (0 BIT OF 0 CH)
   ValName1=IN_Param2  / / VARIABLE NAME
   ValSize1=1 / / byte  / / VARIABLE SIZE
   Adr0=0/8  / / ADDRESS INSIDE CONTROL OBJECT (8 BIT OF 0 CH)

[SERVICE]
```

FIG. 10

```
[Profile]

ObjName= ROBOT

DeviceNum=1
   DevName0=C
   SerialNo0=
   NodeNo0=8  / / COMMUNICATION ADDRESS
   INSize0=2  / / byte
   INadr0=  / / MAPPED ADDRESS TO CONTROLLER MEMORY
   OUTSize0=2  / / byte
   OUTadr0=  / / MAPPED ADDRESS TO CONTROLLER MEMORY
   Communication0=0  / / COMMUNICATIONS MODE
[Attribute]
IN_Num=2
   ValName0=IN_Param1  / / VARIABLE NAME
   ValSize0=1  / / 1byte  / / VARIABLE SIZE
   Adr0=0/0  / / ADDRESS INSIDE CONTROL OBJECT (0 BIT OF 0 CH)
   ValName1=IN_Param2  / / VARIABLE NAME
   ValSize1=1 / / byte  / / VARIABLE SIZE
   Adr0=0/8  / / ADDRESS INSIDE CONTROL OBJECT (8 BIT OF 0 CH)

OUT_Num=2
   ValName0=OUT_Param1
   ValSize0=1  / / 1byte  / / VARIABLE SIZE
   Adr0=0/0  / / ADDRESS INSIDE CONTROL OBJECT (0 BIT OF 0 CH)
   ValName1=IN_Param2  / / VARIABLE NAME
   ValSize1=1 / / byte  / / VARIABLE SIZE
   Adr0=0/8  / / ADDRESS INSIDE CONTROL OBJECT (8 BIT OF 0 CH)

[SERVICE]
   ServiceNum=1
   ServiceName0=BYTEAdd_Val([IN]BYTE  X[IN]BYTE  Y)
```

FIG. 12

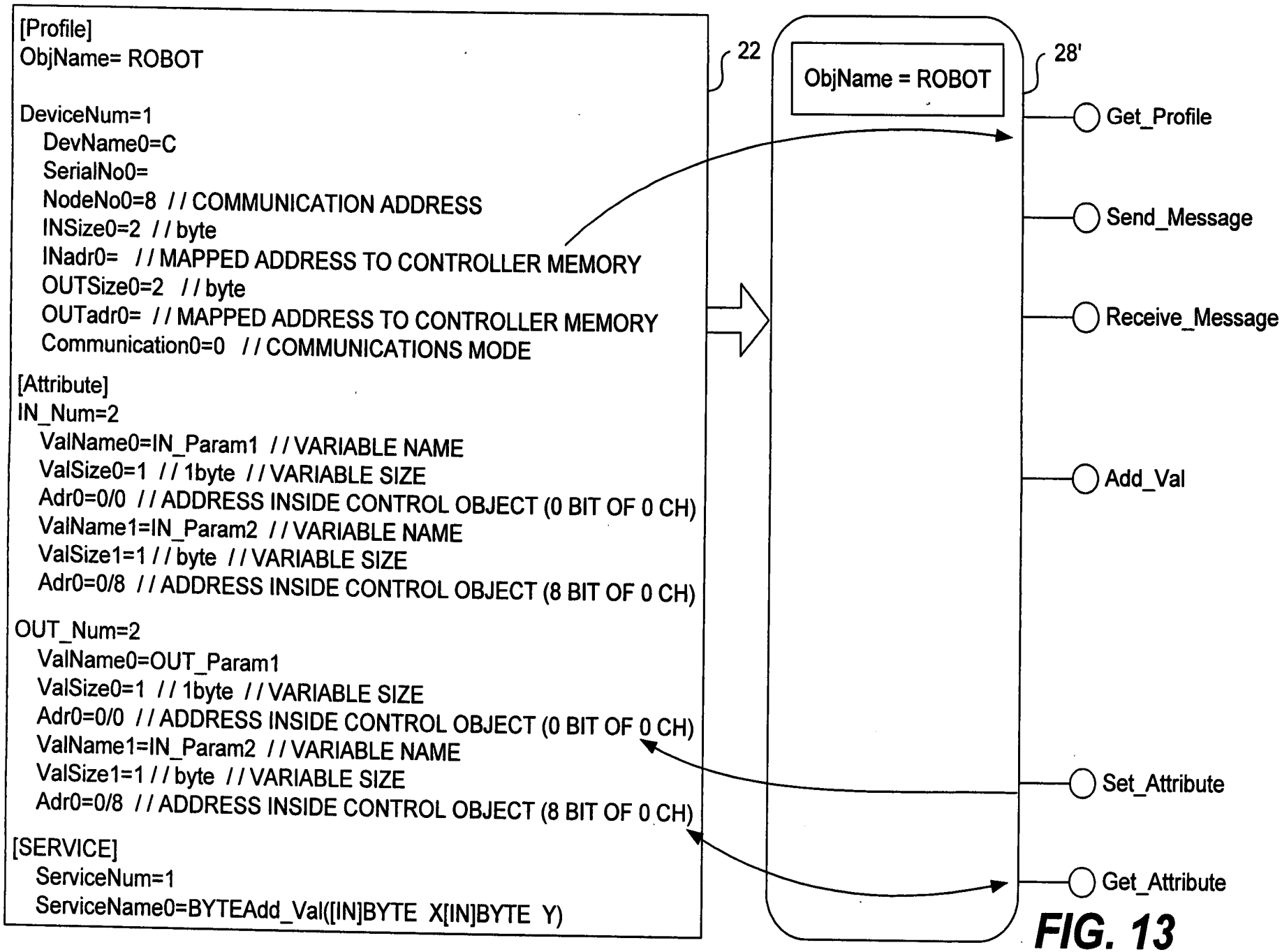

FIG. 13

REPLACEMENT SHEET

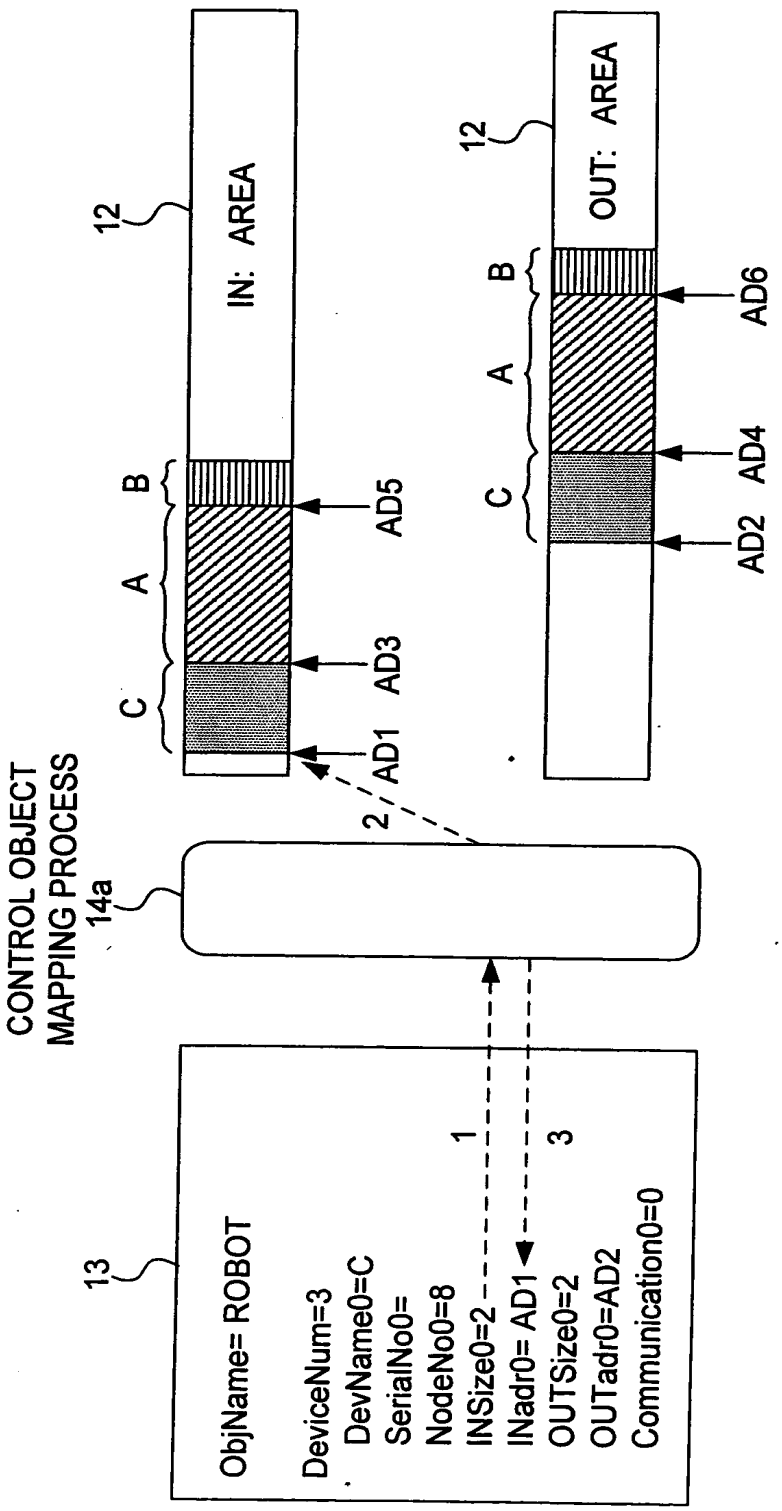
13
ObjName= ROBOT
DeviceNum=3
DevName0=C
SerialNo0=
NodeNo0=8
INSize0=2
INadr0= AD1
OUTSize0=2
OUTadr0=AD2
Communication0=0
1
2
3
CONTROL OBJECT
MAPPING PROCESS
14a
12
IN: AREA
C
A
B
AD1
AD3
AD5
12
OUT: AREA
C
A
B
AD2
AD4
AD6

FIG. 14

```
ObjName= ROBOT

DeviceNum=3
  DevName0=C
  SerialNo0=SN-01
  NodeNo0=8
  INSize0=2
  INadr0= AD1
  OUTSize0=2
  OUTadr0=AD2
  Communication0=0
  DevName1=A
  SerialNo1=
  NodeNo1=3
  INSize1=4
  INadr1= AD3
  OUTSize1=4
  OUTadr1=AD4
  Communication1=0
  DevName2=B
  SerialNo2=
  NodeNo2=1
  INSize2=1
  INadr2= AD5
  OUTSize2=1
  OUTadr2=AD6
  Communication2=0
```

FIG. 15

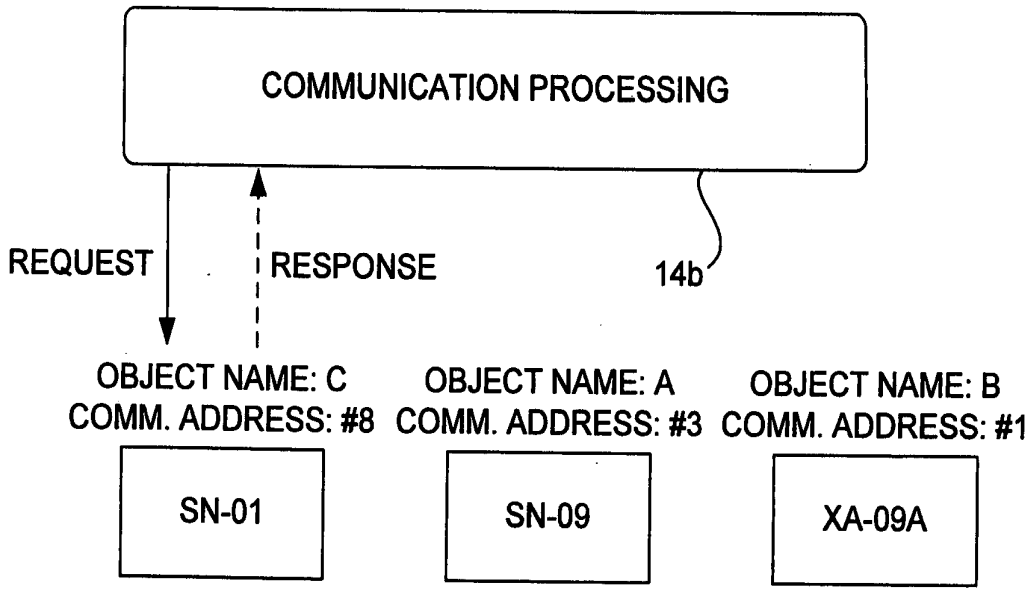

FIG. 16

REPLACEMENT SHEET

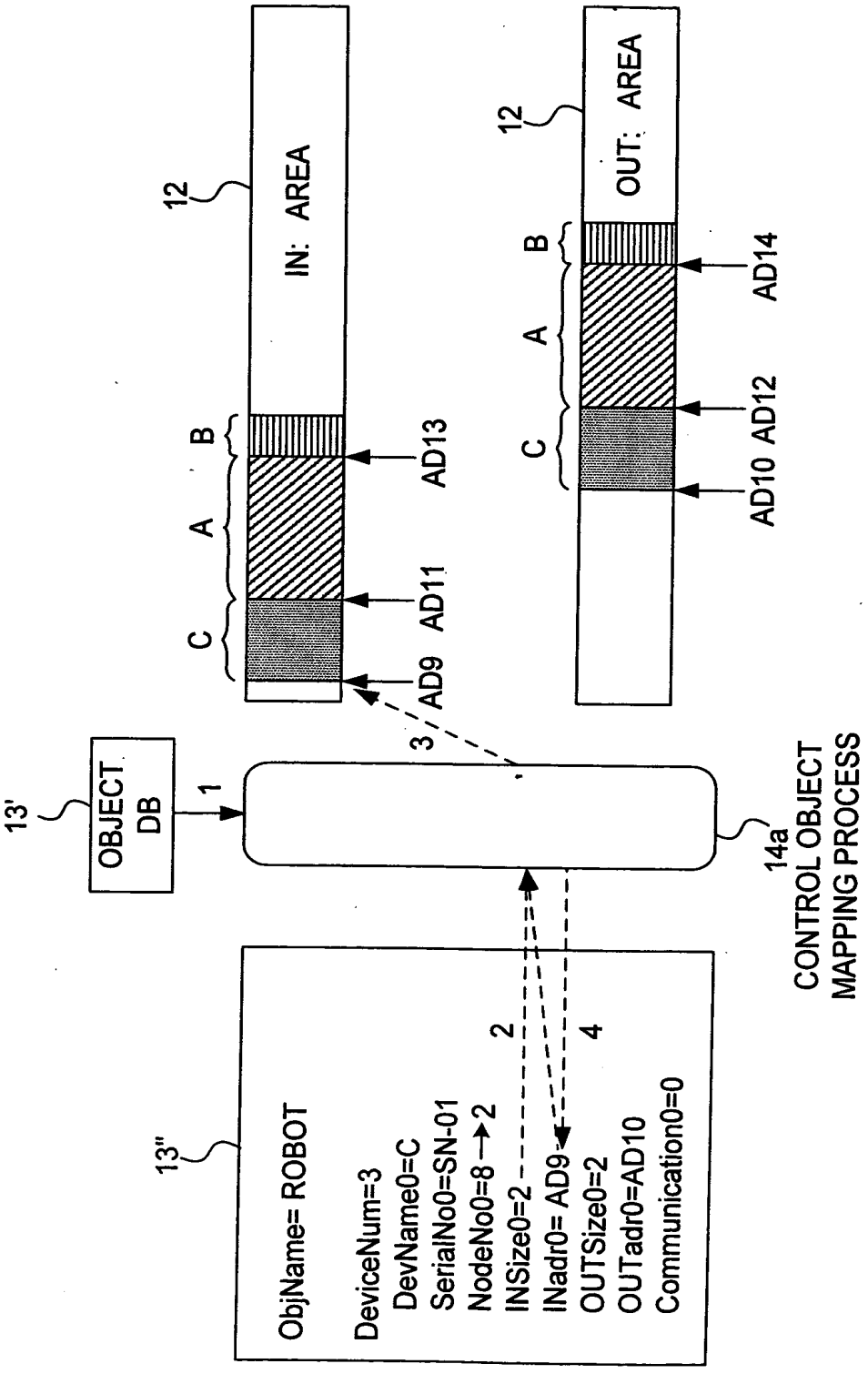
12
IN: AREA
C
A
B
AD9
AD11
AD13
12
OUT: AREA
C
A
B
AD10
AD12
AD14
13'
OBJECT DB
1
3
14a
CONTROL OBJECT MAPPING PROCESS
13"
ObjName= ROBOT
DeviceNum=3
DevName0=C
SerialNo0=SN-01
NodeNo0=8→2
INSize0=2
INadr0= AD9
OUTSize0=2
OUTadr0=AD10
Communication0=0
2
4

FIG. 17

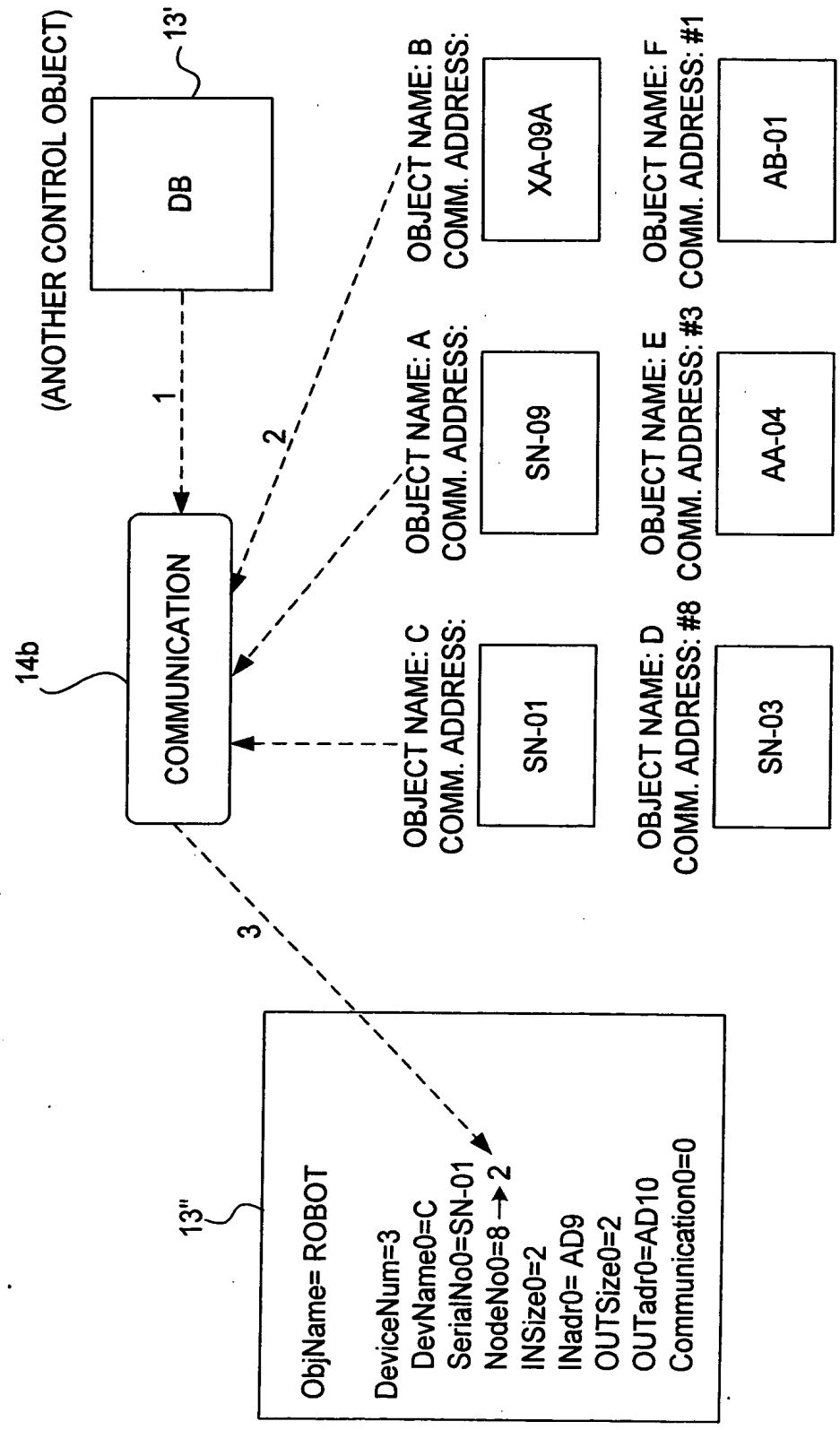
(ANOTHER CONTROL OBJECT)
13'
DB
1
2
14b
COMMUNICATION
3
OBJECT NAME: B
COMM. ADDRESS:
XA-09A
OBJECT NAME: A
COMM. ADDRESS:
SN-09
OBJECT NAME: C
COMM. ADDRESS:
SN-01
OBJECT NAME: F
COMM. ADDRESS: #1
AB-01
OBJECT NAME: E
COMM. ADDRESS: #3
AA-04
OBJECT NAME: D
COMM. ADDRESS: #8
SN-03
13"
ObjName= ROBOT
DeviceNum=3
DevName0=C
SerialNo0=SN-01
NodeNo0=8 → 2
INSize0=2
INadr0= AD9
OUTSize0=2
OUTadr0=AD10
Communication0=0

FIG. 18

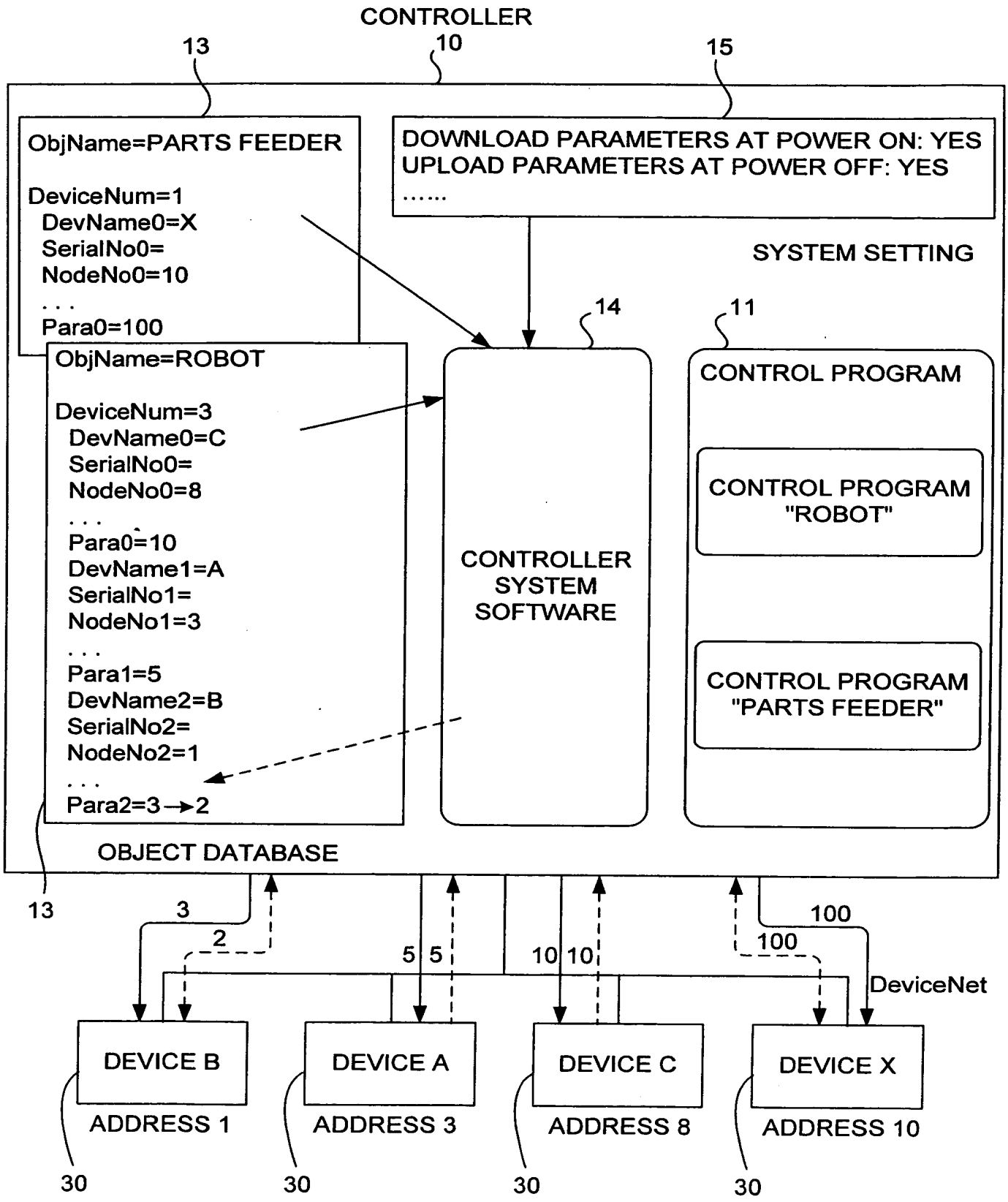
CONTROLLER
10
13
15
ObjName=PARTS FEEDER
DeviceNum=1
DevName0=X
SerialNo0=
NodeNo0=10
. . .
Para0=100
ObjName=ROBOT
DeviceNum=3
DevName0=C
SerialNo0=
NodeNo0=8
. . .
Para0=10
DevName1=A
SerialNo1=
NodeNo1=3
. . .
Para1=5
DevName2=B
SerialNo2=
NodeNo2=1
. . .
Para2=3→2
OBJECT DATABASE
DOWNLOAD PARAMETERS AT POWER ON: YES
UPLOAD PARAMETERS AT POWER OFF: YES
.....
SYSTEM SETTING
14
CONTROLLER SYSTEM SOFTWARE
11
CONTROL PROGRAM
CONTROL PROGRAM "ROBOT"
CONTROL PROGRAM "PARTS FEEDER"
13
3
2
5 5
10 10
100
100
DeviceNet
DEVICE B
ADDRESS 1
DEVICE A
ADDRESS 3
DEVICE C
ADDRESS 8
DEVICE X
ADDRESS 10
30
30
30
30

FIG. 19

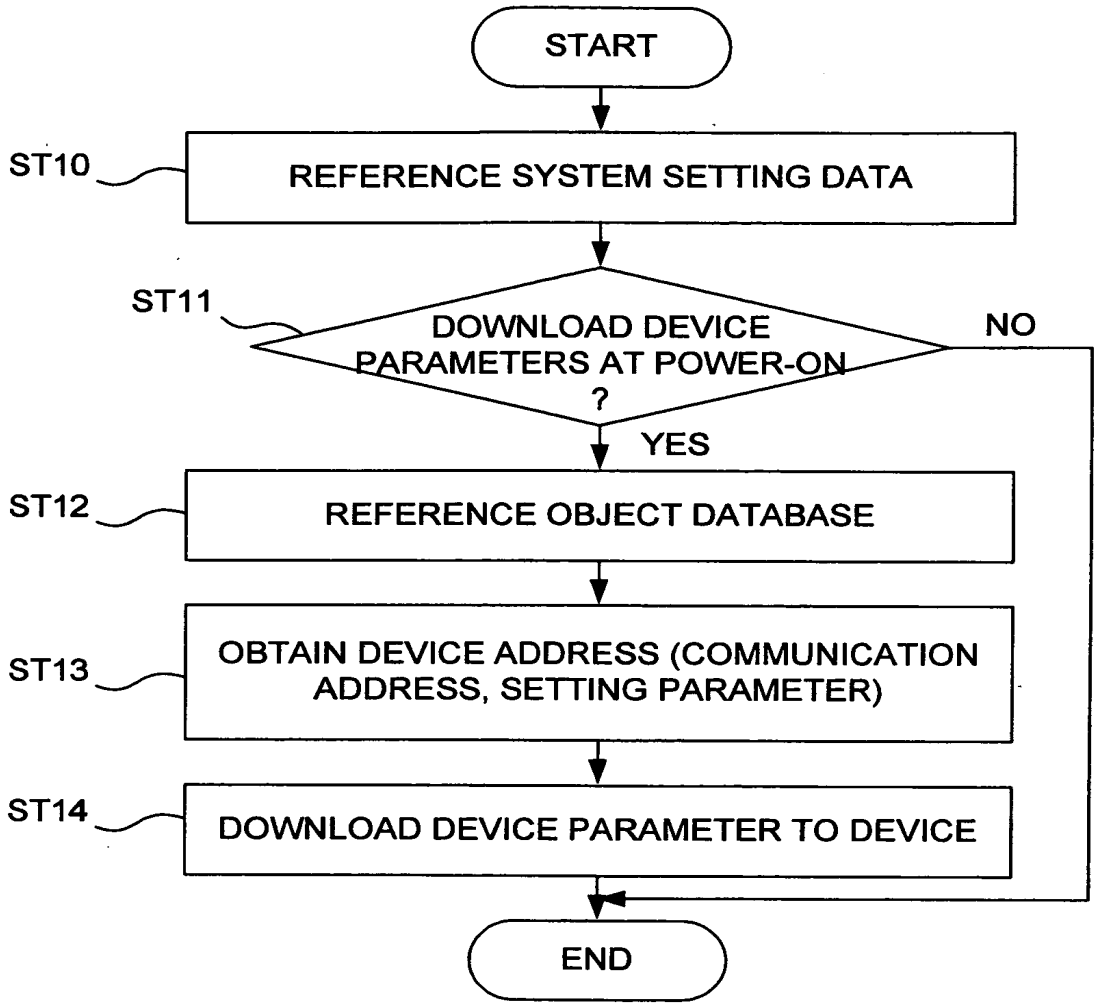
START
ST10
REFERENCE SYSTEM SETTING DATA
ST11
DOWNLOAD DEVICE PARAMETERS AT POWER-ON ?
NO
YES
ST12
REFERENCE OBJECT DATABASE
ST13
OBTAIN DEVICE ADDRESS (COMMUNICATION ADDRESS, SETTING PARAMETER)
ST14
DOWNLOAD DEVICE PARAMETER TO DEVICE
END

FIG. 20

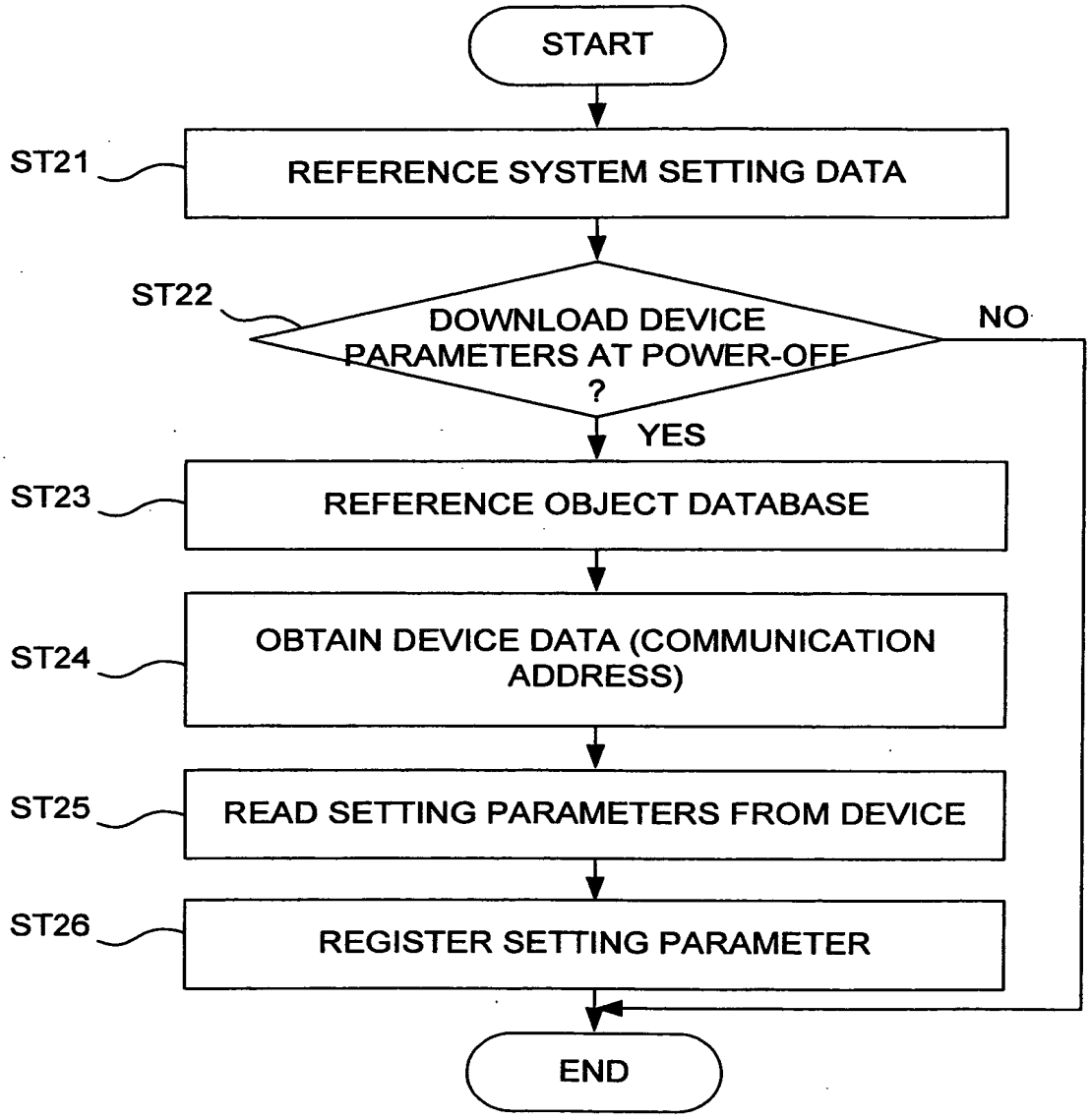
START
ST21
REFERENCE SYSTEM SETTING DATA
ST22
DOWNLOAD DEVICE PARAMETERS AT POWER-OFF ?
NO
YES
ST23
REFERENCE OBJECT DATABASE
ST24
OBTAIN DEVICE DATA (COMMUNICATION ADDRESS)
ST25
READ SETTING PARAMETERS FROM DEVICE
ST26
REGISTER SETTING PARAMETER
END

FIG. 21

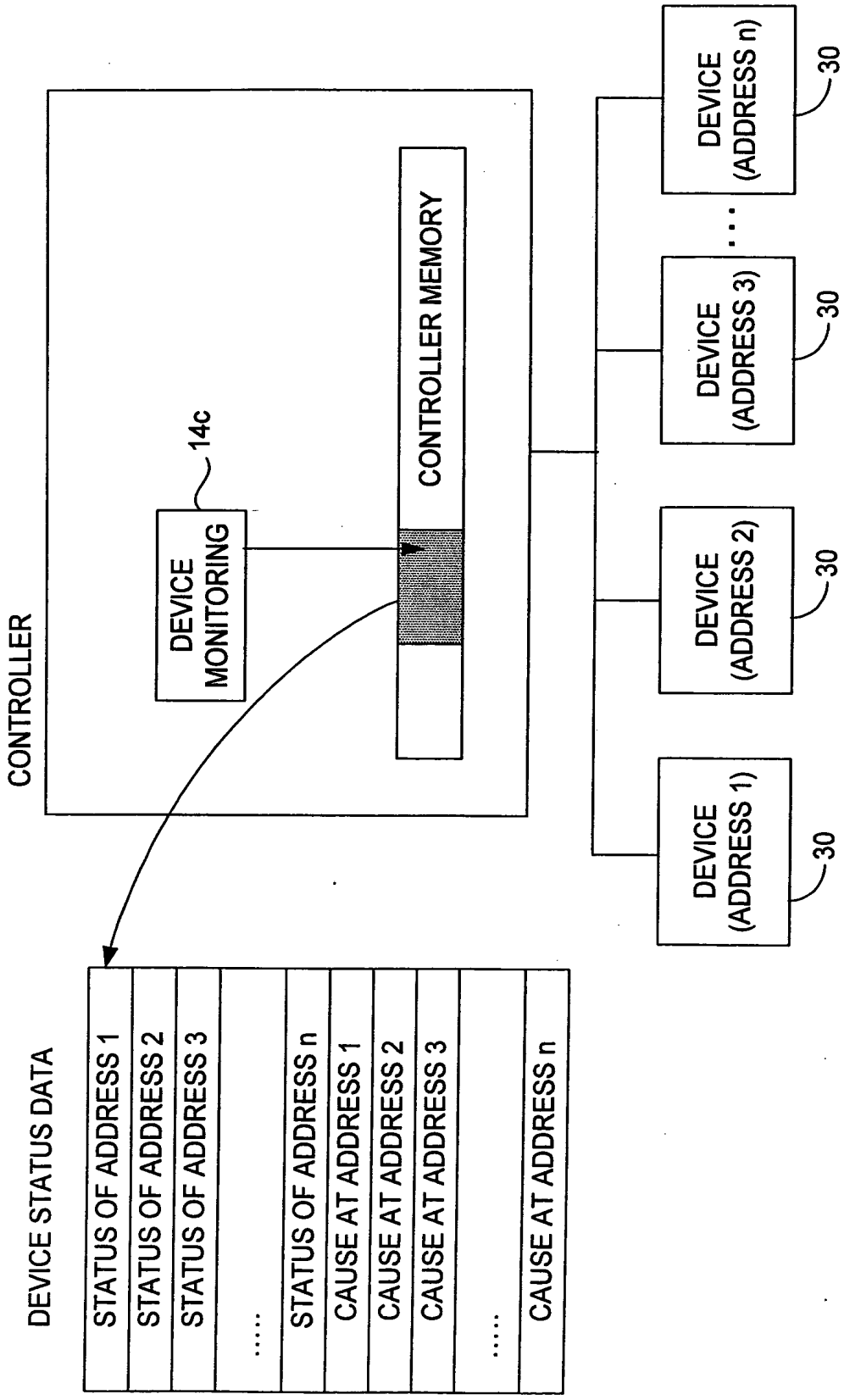
CONTROLLER
DEVICE MONITORING
14c
CONTROLLER MEMORY
DEVICE (ADDRESS 1)
30
DEVICE (ADDRESS 2)
30
DEVICE (ADDRESS 3)
30
DEVICE (ADDRESS n)
30
DEVICE STATUS DATA
STATUS OF ADDRESS 1
STATUS OF ADDRESS 2
STATUS OF ADDRESS 3
.....
STATUS OF ADDRESS n
CAUSE AT ADDRESS 1
CAUSE AT ADDRESS 2
CAUSE AT ADDRESS 3
.....
CAUSE AT ADDRESS n

FIG. 22

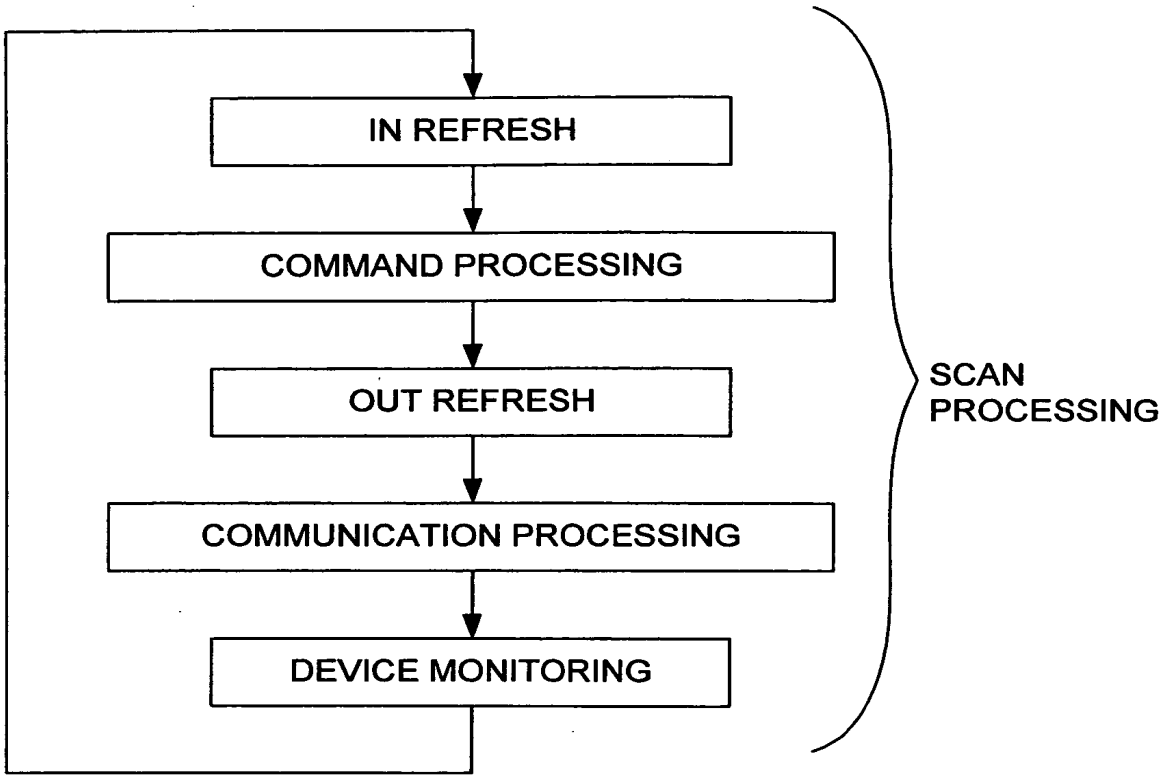
IN REFRESH
COMMAND PROCESSING
OUT REFRESH
COMMUNICATION PROCESSING
DEVICE MONITORING
SCAN PROCESSING

FIG. 23

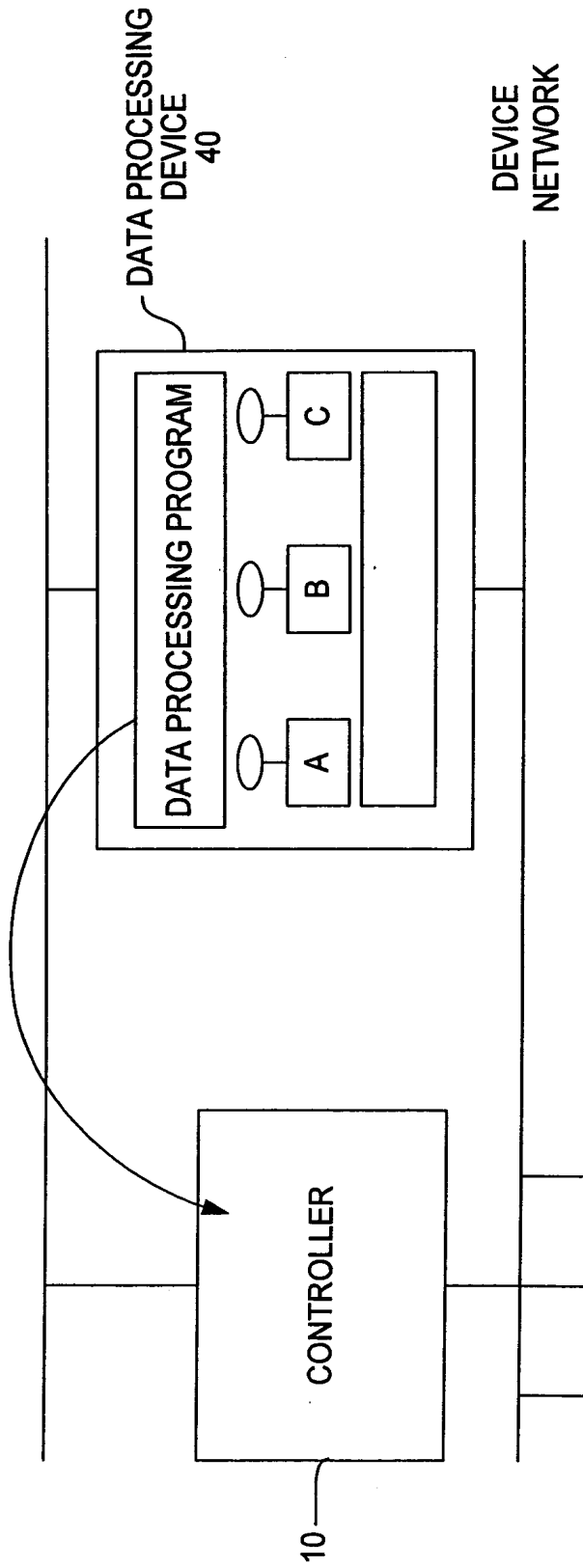
DATA PROCESSING DEVICE
40
DEVICE NETWORK
DATA PROCESSING PROGRAM
A
B
C
CONTROLLER
10
30
DEVICE A
30
B
30
C

FIG. 24